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ELECTRICITY AND MAGNETISM.

A Treatise on Electricity and Magnetism. By E. Mascart and J. Joubert. Translated by E. Atkinson. Vol. II. (London: De La Rue and Co., 1888.)

THE English translation of the second volume of the valuable work of MM. Mascart and Joubert is a welcome addition to the class, none too large, of really substantial English books on electricity. We have already directed the attention of the readers of NATURE to the first volume of this work; and we took occasion to point out that in their exposition of the subject the authors follow very closely the general methods of Clerk-Maxwell. That they do so is a great advantage for the English student; because it enables him, without breach in the continuity of his studies, to use Mascart and Joubert as a commentary upon Maxwell, who is often by no means easy reading. The French work is also supplementary to Maxwell, for writers avoid as much as possible the purely theoretical side of electrical science, and treat electrical phenomena, more especially in their second volume, as subjects of observation, and, above all, of measurement. This volume, which is now before us, is, in fact, an epitome of all the wisdom in exact electrical measurement which has been gained during a period of extraordinary activity in that field. This period began with the researches of Gauss and Weber; and may perhaps be said to have culminated in the great series of determinations of the absolute units which were made about the time of the Congress of Electricians at Paris in 1884. The prominent part taken by MM. Mascart and Joubert in this work has well fitted them to record with precision the details of the leading methods by which it was accomplished, and it would be hard to refer the student of electrical science to an authority on electrical measurement at once so clear and precise in detail, and, with a few small and evidently accidental exceptions, so manifestly candid and fair, as the second volume of the treatise of Mascart and Joubert.

The space at our disposal in the pages of NATURE allows us to give but a brief summary of the contents of this volume. Part I. deals with the auxiliaries of electrical measurement, such as the measurement of angles, of the periods and amplitudes of oscillations, of couples, and of such properties of circular currents as are important in the construction of galvanometers and other electrical instruments. As an example of the care with which the subject is treated, we may refer to the discussion, in §§ 659, 660, of the power of a telescope, and of the relation that ought to subsist between the dimensions of a graduated circle and of the telescope with which it is associated. The conclusion of this discussion is marred in the English version by inadequate translation. Thus, for example, "un cercle de ce diamètre [80 cm.] devra donc être associé à une lunette de 16 centimètres d'ouverture," does not mean "a circle of this diameter is therefore comparable with a telescope of 16 cm. aperture." The meaning is, that, to get the full use of the circle, a telescope having an objective lens of 80 cm. aperture is required; and that a more powerful one is unnecessary.

Part II., which is the kernel of the volume, describes the various electrical measurements as they are carried out in practice. There are chapters on electrometry, and on measurement of current, resistance, electromotive force, capacity, constants of coils, absolute resistance, and the fundamental velocity, *v*. The methods are described in great variety and with great detail. They are illustrated by giving not only the old classical results, but also by means of the most recent examples. Nothing is attempted like the exhaustive catalogue of results, good, bad, and indifferent, which makes Wiedemann such an invaluable book of reference. Experimental results are given simply as part of the exposition of the methods by which they are obtained. It is probably for this reason that the authors make no mention of the valuable experiments on dieletric strength recently made by their fellow-countryman, Baille.

Part III. is devoted to magnetic measurements, and is excellent so far as it goes. It is by no means so exhaustive as the purely electrical part; and, probably for that very reason, will be found to be lighter reading for the tyro in electricity and magnetism; to such we commend more especially the parts relating to the determination of so-called magnetic poles and to the magnetism of feebly magnetic and diamagnetic bodies, subjects which are very frequently imperfectly understood or inadequately expounded in current text-books.

Part IV., which is called a complement, deals with industrial applications, and contains a table of numerical constants. The table of constants gives full references to the sources of such information as it contains, and will be found most useful. The part that deals with industrial applications is to our thinking the least satisfactory part of the book; not because there is any want of clearness or soundness in it, but because it is too short and too scantily illustrated by references to practical cases to give the student any real idea of the problems that surround the electrical engineer.

In describing the various methods of electrical measurement the authors are, on the whole, very sparing of criticism. They seem to assume that they are addressing an audience fitted to draw their own conclusions from the facts put before them. Occasionally the weak points of the methods used by various experimenters are pointed out, but the authors never indulge in that species of criticism which consists in treating a fellow-labourer and all his productions with indiscriminate scorn because the critic has discovered some microscopic oversight, or believes that he has wrung one more decimal place from reluctant Nature.

There are one or two little points which might be amended in a future edition. For example, the elegant method of discussing resisted motion by means of the equiangular spiral, given in § 682, should be attributed to its author, Prof. Tait. The use of the fish-back galvanometer-needle (*i.e.* a needle made up of a number of separate parallel needles) was not an invention of M. Deprez, at least not an original invention; for the writer used, more than twelve years ago, a galvanometer fitted with a needle of this sort, which had been constructed for the B.A. Committee of 1867. Who the inventor was, is doubtful; but probably he took his idea from the laminated magnets constructed by Jamin and others. Perhaps the most serious historical oversight is made in § 1274, where, in

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speaking of the graphical characteristic of a dynamo, language is used which would lead the reader to infer that this important method in the theory and practice of electrical engineering was introduced by M. Marcel Deprez, the fact being that it was first introduced, fully explained, and actually used by Dr. Hopkinson in 1879.[1] What M. Deprez did, was, we believe, simply to give a name to Hopkinson's curve, and to further develop its applications. It would be easy to correct, in footnotes or otherwise, these and a few similar small blots on a work which is, in most respects, remarkably fair and cosmopolitan in its history.

Regarding the work of the translator, we can, on the whole, speak very favourably. There are, however, passages here and there which are so inadequately translated that they suggest the idea of an inferior assistant not always sufficiently overlooked. Compare, for example, the following piece of the original with the accompanying translation:—

> "Si la loi était générale, on en conclurait, pour le cas de deux plateaux parallèles, que la production de l'étincelle correspond toujours à une même valeur de la densité électrique et, par suite, de la force électrique et de la pression électrostatique, ou, dans les idées de Maxwell, à un même état ou une même énergie spécifique du milieu interposé."

> "If the law was general, we should conclude, for the case of two parallel plates, that the production of electricity almost represents the same value of the electrical density, and therefore of the electrical force and the electrostatic pressure, or, as in Maxwell's views, to the same condition or the same specific energy of the interposed medium."

It will be seen that the English passage is not a translation of the French, is not English, and means nothing. We mention this, by far the worst, case of loose translation that we have noticed, to draw the attention of the English editor to the need there is for revision. Such corrections as are absolutely necessary might be given on a fly-leaf; and, in order to help, we mention a few things that we have noticed. Some are misprints, some wrong, some merely doubtful.

P. 39, "compass of horizontal intensity"?

P. 41, "observations" (oscillations?)

P. 48, "collate" (collect?)

P. 50, "bodies of easy construction"?

P. 237, "combine the experiment"?

P. 293, "but they are not sufficiently so, &c."?

P. 557, "*residues* of the Leyden jar"?

P. 577, "induced *charges*" (décharges induites)?

P. 578, "to *make the constant* of the ballastic galvanometer" (faire la tare: why use tare? Tare is English).

P. 878, "regulation of a galvanometer" (tarage d'un galvanomètre)?

Notwithstanding minor shortcomings, this English translation of the work of MM. Mascart and Joubert will be of great use to English readers; and we hope that it will not be thought that, by calling attention to inaccuracies here and there, we mean to depreciate the labour of the editor, or to undervalue the debt which the English scientific public owes him for rendering more accessible one of the most important electrical treatises of the day.

G. C.

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[1] See his papers in the Proceedings of the Institution of Mechanical Engineers, April 1879 and April 1880.

SYNOPTICAL FLORA OF NORTH AMERICA.

Synoptical Flora of North America: the Gamopetalæ. A Second Edition of Vol. I. Part 2, and Vol. II. Part 1, collected. By Asa Gray, LL.D. Large 8vo. 480 + 494 pp. (Washington: Published by the Smithsonian Institution, 1888.)

THE first feeling which the sight of this book reawakens in the mind is one of deep regret that Prof. Asa Gray did not live to carry out the plans he had entertained so long for an elaboration of a complete flora of Temperate North America upon one uniform plan. A work of this scope was planned by Dr. Torrey and himself when he was quite a young man, and the first part appeared as long ago as 1838. It was soon found by the authors that it was impossible to identify satisfactorily the plants which had been named by their predecessors without studying the European Herbaria; and in order to do this Dr. Gray spent a year in Europe in 1838–39. Another instalment, which extended to the end of Polypetalæ, was published in 1840, and the remainder of the first volume, extending to the end of Compositæ, in 1842. Then Dr. Gray accepted the post of Fisher Professor of Natural History in the University of Harvard, and what with teaching and herbarium work, and the preparation of the successive five editions of his "Flora of the Northern United States," and the elaboration of the new collections that poured in as fresh territories were explored and settled, his time was fully occupied for thirty-five years. In 1878 he returned to the more comprehensive work, and in that year published the first part of the second volume, which includes the remaining orders of Gamopetalæ, from Goodeniaceæ to Plantaginaceæ. In 1884 he issued a revised edition of the part devoted to the Compositæ and small allied orders. The work we have now before us is a reprint of the whole of the Gamopetalæ, with two supplements, embodying additions and corrections up to the end of 1885. Although the title-page bears the date of 1888, it was really issued, as the secondary title-page indicates, in January 1886, and we have had it in use at Kew for a couple of years. The present volume, therefore, covers the central third, brought up to date, of the complete undertaking as planned; and at the beginning the Polypetalous Dicotyledons are still left as they stood in 1840, except for the most useful bibliographical index, brought up to date, which Dr. Sereno Watson issued in 1878; and the Incompletæ and Monocotyledons, to which Dr. Watson has happily devoted special attention during many years, have still to be dealt with.

The flora of Temperate North America contains about the same number of species as that of the whole of Europe, but of course the orders are to a certain extent different, and others enter in the two floras in very different proportions. In the present work there are described 3521 species of Gamopetalous Dicotyledons, of which all but 162 are indigenous. They fall under 562 genera, of which 520 are native. The American Compositæ alone, 1636 species, far more than outnumber the whole Phanerogamic flora of Britain. Next to Compositæ come Scrophulariaceæ, represented by 367 species and 38 genera. Of Hydrophyllaceæ, an order nearly restricted to North America, there are 129 species and 14 genera; of Polemoniaceæ, another nearly endemic

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